Operating Experience Weekly Summary 97-48

November 21 through November 27, 1997

Table of Contents

Visit Our Web Site

The Weekly Summary is available, with word search capability, via the Internet at **http://tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html**. If you have difficulty accessing the Weekly Summary at this URL, please contact the ES&H Info Center, 1-800-473-4375 for assistance.

EVENTS

1. UNEXPECTED REACTION CAPTURED ON FILM

On November 18, 1997, at the Hanford Site Plutonium Finishing Plant, facility managers determined that an unreviewed safety question existed after they reviewed a photograph of an unexpected reaction that occurred when operators opened a plutonium storage can. Based on the photograph and technical reviews, technical support personnel determined that a pressure excursion, large enough to blow out a glovebox window, could occur when the storage cans are opened. Investigators also determined that this is a credible accident scenario that is not currently included in the facility authorization basis. (ORPS Report RL--PHMC-PFP-1997-0027)

On December 23, 1996, operations personnel noticed a spark when they opened a plutonium storage can inside a glovebox. They had observed similar reactions before and believed they were caused by a statically induced spark; however, this time the reaction was captured on videotape. Facility personnel were filming the process to provide photographs for a technical report on long-term plutonium metal storage. On May 30, 1997, facility personnel reviewed a still photograph made from the videotape and determined that the reaction seemed to be a flash of fire rather than a statically induced spark.

The facility manager directed technical support personnel to investigate further. The storage can consisted of three individual cans stacked one inside the other. Technical support personnel determined that the inner-most can contained a plutonium button and was surrounded by a plastic bag. They also determined that the button had oxidized and consumed the air in the inner-most can. Because the seal on the inner-most can was not airtight, it drew a vacuum from the second or third can. This, along with degradation of the plastic, enhanced the oxidization process and produced plutonium oxide inside the cans. Technical support personnel determined that, when operations personnel opened the inner-most can, it produced the fire flash. Using radiography, they determined that can-buckling may indicate the presence of plutonium oxide. Radiography personnel determined that approximately one to two percent of the cans at the Plutonium Finishing Plant exhibit this phenomenon. Investigators and technical support personnel are continuing to evaluate this event.

NFS reported numerous events in the Weekly Summary about plutonium storage. Following are some examples.

- Weekly Summary 94-09 reported that plutonium oxide was released from a vessel containing plutonium metal at Los Alamos National Laboratory. The incident resulted from the rupture of an inner storage vessel caused by mechanical forces from expansion due to plutonium oxidation. (ORPS Report ALO-LA-LANL-TA55-1993-0039; DP Safety Information Letter 93-05)

- Weekly Summary 94-08 reported that an operator at the Savannah River Site discovered a bulging lid on a sealed 40-ounce plutonium oxide storage can. Investigators later discovered six other slightly deformed cans containing stabilized plutonium oxide blended with other stable oxides. (ORPS Report SR--WSRC-FBLINE-1994-0010)

This event illustrates the need for a questioning attitude when unexpected conditions are observed. Although, operations personnel had observed this phenomenon before, no one believed it was a problem until the photograph was developed. Lack of a questioning attitude can lead to unidentified and unassessed hazards that could result in loss of confinement, personnel or facility contamination, or personnel injury.

Operations supervisors and managers should ensure that operators exhibit a questioning attitude and do not become complacent with routine operations. Facility managers should review the following documents to ensure that practices and procedures are properly implemented and provided for in the facility authorization bases.

- DOE O 5480.23, *Nuclear Safety Analysis Reports*, requires hazard analysis to ensure comprehensive, integrated, and balanced risk management of all safety and environmental hazards. Section 3 requires analyses of expected releases, exposures, and accidents. It also requires consideration of residual risks to ensure that the risks and consequences of operation are acceptable and to ensure conformance with safety design objectives.

- DOE Safety Information Letter 93-05, "Potential Worker Contamination from Failed Plutonium Storage Containers," describes safety problems associated with plutonium storage containers. The letter includes detailed information on plutonium oxidation processes in containment vessels that do not have certified hermetic seals.

- DOE-STD-3013-96, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage,* provides a summary of packaging and storage criteria for plutonium metals. It states that plutonium materials must be in stable forms and packaged in containers designed to maintain their integrity under normal storage conditions and during anticipated handling accidents.

- DOE-HDBK-1081-94, *Primer on Spontaneous Heating and Pyrophoricity*, provides information on plutonium properties, including, metal; oxides; oxidation; hydrides; and pyrophoricity. It also discusses plutonium storage and handling requirements.

- DOE/NS-0013, Safety Notice 93-1, "Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers," February 1993, describes lessons learned on safe storage and handling of waste containers and drums. The notice specifically discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors.

A copy of the handbook can be accessed via the Internet at URL http://www.doe.gov/html/techstds/standard/standard.html. Safety Notice 93-1 can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: plutonium storage, unreviewed safety question

FUNCTIONAL AREAS: Licensing/Compliance, Materials Handling/Storage

2. DEACTIVATION PLANNING ASSUMPTIONS RESULT IN WATER HAMMER

On November 14, 1997, at the Hanford Site B Plant, a nuclear process operator detected water hammer in a condensate line that passed through the plant. Deactivation workers isolated the condensate line several months ago because a planned boiler replacement project would eliminate the need for the line. The line normally contains steam. However, because the boiler replacement project was delayed and air temperatures have turned cooler, a mixture of steam and condensate formed in the line. This resulted in a water hammer. Facility managers evacuated the immediate area and drained approximately 900 gallons of water from the

condensate line. Water hammer events can be highly energetic and have resulted in deaths at DOE facilities. (ORPS Report RL--PHMC-BPLANT-1997-0017)

The B Plant facility is being deactivated, and there are no live steam loads in the facility. However, a steam header, along with two steam traps and their associated condensate line, must remain active to support another operating facility. Approximately five months ago, deactivation workers closed the condensate line drain isolation valve. Deactivation managers determined that draining the condensate line was unnecessary because they knew that a boiler replacement project, planned for completion in September 1997, would entirely eliminate the need for the steam condensate line. Deactivation managers also knew that as long as the outside air temperature remained at normal levels, no liquid water would form in the condensate line before September. The planned boiler replacement project has not yet taken place, and recent cooler outside air temperatures caused liquid to accumulate in the condensate line, resulting in the water hammer. Corrective actions include draining the condensate line and installing a temporary modification to drain condensate to the B Plant chemical effluent line.

Facility deactivation managers are responsible for selecting and tracking deactivation end points. Isolation of the condensate line was one end point for the B Plant deactivation project. The water hammer event occurred because deactivation planners assumed that the boiler replacement project would be completed on time. This occurrence highlights the importance of tracking prerequisites to facility deactivation end points, especially when utilities must remain in service. Deactivation managers should make use of the following deactivation guides.

- DOE/EM-0318, *Facility Deactivation Guide Methods and Practices Handbook,* describes how facility-specific end points are defined. The handbook describes methods by which a project manager can derive end points for a facility based on objectives and principles common to all deactivation.

- *EM-60 Material Stabilization and Facility Deactivation Project Policies and Supplemental Information,* describes DOE policies for planning, managing, and conducting nuclear material stabilization and surplus facility deactivation projects.

Specifying and achieving detailed end points rests with the facility deactivation contractor. The contractor should include the following elements when determining appropriate end points.

- Define the method to be used for specifying end points.
- Conduct detailed end-point planning, including coordination with the receiving organization.

- Incorporate end-point planning into the detailed project plan, including work breakdown structure, estimating, and scheduling.
- Create work plans as needed.
- Conduct the work.
- Obtain concurrence from the field office and the receiving organization at appropriate times in the process.

The *Facility Deactivation Guide Methods and Practices Handbook* is available at URL http://em.doe.gov. The *EM-60 Material Stabilization and Facility Deactivation Project Policies and Supplemental Information* will be available in approximately 90 days from the Oak Ridge Remedial Action Program Information Center at (423) 576-6500.

KEYWORDS: deactivation, configuration control, water hammer

FUNCTIONAL AREAS: Deactivation, Configuration Control

3. SAFETY CLASS TRANSFER LINES FAIL TO MEET AUTHORIZATION BASIS

On November 20, 1997, at the Savannah River Site, a cognizant engineer discovered that seismic restraints used to support lead shielding around safety-class tank transfer lines exceeded the tolerances identified in the seismic analysis documentation. Investigators determined that engineers had not evaluated the tolerances to ensure they were within the seismic qualification after construction workers installed the restraints. The facility manager restricted the transfer of contaminated waste into and out of the affected tank and transfer lines. This event is significant because the restraints are required to prevent lead shielding from damaging the transfer lines during a seismic event and damaged lines could result in a release of waste sludge and the spread of contamination. (ORPS Report SR--WSRC-ITP-1997-0043)

Based on pre-qualified drawings, engineers developed the seismic analysis for the tank transfer lines before the piping was installed. The design detail permitted an increased tolerance to install the seismic restraints if construction workers identified interferences with the lead shielding. During the installation of the piping and restraints, construction workers used the increased tolerances, but engineers did not assess these tolerances to ensure the seismic qualifications were maintained after the installation. The engineers did perform a review of the drawings, but they did not walk down the as-built system.

The seismic restraint issue was identified by the cognizant engineer when he performed a walk-down of the transfer systems following the discovery on November 18 that safety-significant U-bolts, credited in the seismic qualification calculation for above ground transfer lines, were missing (ORPS Report SR--WSRC-ITP-1997-0042). Engineers walked down five other tanks and identified no problems. Workers removed the U-bolts in February 1997 to allow for periodic inspection of a defective tank bellows. Because they didn't realize the safety significance of the U-bolts, the workers never replaced them so they could continue inspecting the bellows until it was replaced. The workers also did not close out the work package.

Investigators determined that operators had transferred waste through the transfer lines while the U-bolts were not installed. Compensatory measures would have required the transfer lines to be locked and tagged out of service, preventing their use. Because of these two events, the facility manager restricted waste transfers to ensure authorization basis compliance and prohibit safety concerns. Engineers will evaluate the seismic analysis and design requirements and will take appropriate actions before waste transfers can resume. The facility manager is considering marking or color-coding safety-significant items, such as seismic supports, to increase awareness of their importance.

This event illustrates the importance of conducting field walk-downs to determine if components are installed in accordance with the authorization basis documentation. DOE-STD-1073-93-Pt.2*, Guide for Operational Configuration Management Program*, Appendix II-C, provides instructions for field walk-downs to establish the as-found physical configuration of the facility. The walk-downs should identify any discrepancies between the as-found condition and associated facility documentation, such as drawings and safety analysis reports.

The event also illustrates the need for increased personnel awareness of safety-class items and the need to ensure that facility managers implement compensatory measures if work is performed that affects safety-class items. DOE O 6430.1A, *General Design Criteria*, section 1300-3.2, states that safety-class items are systems, components, and structures whose failure could adversely affect the environment or the safety and health of the public. Section 0140 states that the facility design should be conducted under quality assurance requirements. Systematic actions and controls should be used to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

KEYWORDS: authorization basis, seismic, shielding, transfer pipe, work control

FUNCTIONAL AREAS: Configuration Control, Design, Licensing/Compliance, Work Planning

FINAL REPORTS

1. UNREVIEWED SAFETY QUESTION ON INADEQUATE CRITICALITY ALARM COVERAGE

This week OEAF engineers reviewed a final report where facility modifications at the Savannah River Site affected the audibility of nuclear incident monitor bells. On April 25, 1997, test personnel discovered that nuclear incident monitor bells did not meet audibility requirements for some areas within the 12-rad evacuation zones. Investigators determined that, over a period of time, facility modifications affected the audibility of the bells and previous testing methods did not reveal the problem. The facility manager declared that there was a potential inadequacy in the authorization basis for testing the nuclear incident monitor bells because alignment was not maintained between the facility configuration and the audibility requirements. A facility operations safety committee evaluated the adequacy of the authorization basis and concluded that a positive unreviewed safety question existed. Failure to evaluate the impact of facility modifications on the nuclear incident monitor alarm system affected the safety of personnel working in areas requiring evacuation. (Weekly Summary 97-18; ORPS Report SR--WSRC-FBLINE-1997-0016)

Previous test procedures verified only that the bells were audible above background at specific locations within facility evacuation zones. DOE facility representatives questioned the validity of the audibility test when they learned that floor markers identifying the location for test measurements were no longer visible. (Weekly Summary 97-14; ORPS Report SR--WSRC-SEPGEN-1997-0001) As a result, engineers re-evaluated the evacuation zones and revised the test procedures to verify that the bells were audible to ensure evacuation of the zones. Testing under the new procedure revealed locations within evacuation zones where the bells were not audible above background noise. Facility personnel determined that facility modifications had introduced barriers (walls and doors) that impaired audibility and that new equipment had increased background noise levels. The authorization basis did not contain sufficient detail to ensure that the impact of facility configuration changes on bell audibility would be appropriately recognized and compensated for.

Facility managers determined that the direct cause of this event was a design problem (inadequate or defective design) because plant modifications did not adequately incorporate the requirements for audibility of the nuclear incident monitoring system. Had engineers performed the appropriate design, hazard, and safety risk reviews and evaluated the changes to facility configuration, the audibility requirements would have been met. Facility managers determined that the root cause was a procedure problem (defective or inadequate procedure) because (1) the previous test procedures verified only that the bells were audible above background at specific locations and (2) the procedures tested only for evacuation and not audibility under normal plant conditions. Had the new, revised test procedures been in place, the as-found condition would not have existed. The following corrective actions will be implemented.

- development of a plant modification traveler for installation of nuclear incident monitor bells to assure that the bells are audible in all areas within the 12-rad evacuation zones

- installation of additional nuclear incident monitor bells where needed

- revision to nuclear incident monitor audibility testing procedures to ensure that (1) all areas that fall within evacuation zones are included in the audibility tests and (2) the procedures include an alignment of equipment to conservatively assure that testing is performed at normal operation background noise levels

- incorporation of a description of the nuclear incident alarm system into the facility basis for interim operation to prevent omitting required reviews for system audibility

NFS reported numerous events in the Weekly Summary about the operation of criticality accident alarms. Following are some examples.

- Weekly Summary 97-07 reported that a quarterly test of the criticality accident alarm system in a facility at the Oak Ridge Y-12 Site indicated that alarms were not audible while equipment was operating. Investigators determined that new equipment had been installed that changed the baseline decibel levels. (ORPS Report ORO--LMES-Y12SITE-1997-0008)

- Weekly Summary 96-20 reported that inaudible criticality accident alarms in utility rooms containing air-handling units resulted in an unreviewed safety question at the Oak Ridge Y-12 Site. There were no visual alarms, and the high noise level from the air-handling units prevented personnel from hearing criticality accident alarms or other emergency notifications. Investigators learned that quarterly surveillance testing did not require physical verification of system audibility by zones and that the need for visual alarms had been overlooked. (ORPS Report ORO—LMES-Y12SITE-1996-0020)

These events illustrate the importance of thorough technical reviews of modifications and a disciplined configuration management program. Proposed modifications to a system need to be thoroughly reviewed for impact on the design basis and how they could affect existing facility systems and processes. Facility managers should ensure all personnel are made aware of the need for detailed modification reviews and a stringent configuration management change control process.

DOE-STD-1073-93-Pt.1 and Pt.2, *Guide for Operational Configuration Management Program, Including the Adjunct Programs of Design Reconstitution and Material Condition and Aging Management,* addresses modification technical reviews as part of the change control element. Section 1.3.4.2 of the standard recommends that the design authority review and approve changes before they are implemented. The section states that these reviews should be used to evaluate safety, environmental, and mission impacts and to determine post-implementation acceptance criteria. The standard also discusses the control of modifications that can lead to temporary or permanent changes in design requirements, facility configuration, or facility documentation. The standard discusses identifying changes, conducting technical and management reviews, and implementing and documenting changes. DOE O 6430.1A, *General Design Criteria*, section 1300-6.5.5, states: “Warning and alarm systems shall be designed, installed, and tested to ensure that they can be heard in the ambient conditions of the area they are intended to cover.”

ANSI/ANS-8.3-1997, *Criticality Accident Alarm System*, provides direction for establishing and maintaining criticality and nuclear incident alarm systems. The standard requires quarterly checks of audible alarms in areas that may require personnel evacuation and states that alarms shall be of sufficient volume and coverage to be heard in these areas.

KEYWORDS: criticality safety, modification control, procedure, surveillance, test

FUNCTIONAL AREAS: Configuration Control, Emergency Planning, Nuclear/Criticality Safety, Procedures, Surveillance

2. SIX WORKERS AND FACILITY CONTAMINATED AT IDAHO

This week OEAF engineers reviewed a final report about the spread of contamination during maintenance on a remote-handling manipulator at the Idaho National Engineering Environmental Laboratory Hot Cell Facility. On September 17, 1997, six workers and approximately 10,000 square feet of the facility were contaminated with europium. Radiological and Environmental Sciences Laboratory personnel confirmed that two workers received uptakes of 10 mrem committed effective dose equivalent, with a maximum organ dose of 57 mrem committed dose equivalent to bone surfaces. The vice president of Nuclear Operations requested an independent investigation of this event. Investigators determined that the workers caused the airborne spread of contamination by cutting the highly contaminated sleeve off the manipulator without adequate containment or ventilation. Poor work planning, improper resource allocation, and inadequate training resulted in the spread of contamination and uptakes by two workers. (OE Weekly Summary 97-39 and ORPS Report ID--LITC-TRA-1997-0021)

The workers had extracted the manipulator from a wall and covered it with a plastic sleeve to control contamination. While they were removing the manipulator, a radiological control technician told them that the radiological levels exceeded the allowable limit in the radiological work permit. The workers re-inserted the manipulator to within approximately 2 feet of the wall, cut and removed the sleeve, completed insertion of the manipulator, and exited the area. As they were exiting, the radiological control technician measured excessive levels of contamination, and the continuous air monitor alarmed.

The investigation team determined that the root cause of this event was a management (work organization/planning) deficiency. The workers planned to partially remove the manipulator, repair a pulley through the sleeve, and re-insert the manipulator. Investigators determined that someone wrote the work instructions for the complete removal of the manipulator and did not address partial removal. Radiological Controls Engineering staff, the as-low-as-reasonably-possible committee, and facility managers reviewed and approved the work instructions before work began. However, they failed to identify that the work instructions did not describe the actual work plan. Investigators determined that partially removing the manipulator was a significant change to the scope of the work instructions that created unanticipated radiological conditions. Corrective actions include the following.

- Train workers on procedural compliance.
- Counsel managers on responsibilities related to the approval of work documents and the oversight of facility operations.

The investigation team determined that the contributing causes for this event were management problem (improper resource allocation) and training deficiency (inadequate content). They also determined that the radiological control technician's lack of facility experience and familiarity with the physical nature of europium was a contributing cause. Europium is a rare earth metal that has a powder-like consistency, can easily become airborne, and is difficult to control. The team determined that the training deficiency stemmed from lack of instructions for manipulator insertion and sleeve-cutting, as well as lack of management guidance regarding actions required when a radiological work permit is exceeded. They also determined that the radiological control technician allowed workers to remove the sleeve without characterizing its radiological contents. Corrective actions include the following.

- Brief workers on actions to be taken when a limiting condition of a radiological work permit is reached.

- Require radiological control technicians to characterize radiological containment contents before opening them to the atmosphere.

- Improve radiological control facility support.

- Provide training to hot-cell qualified technicians on the special hazards associated with europium.

The investigation team reviewed seven similar events that have occurred at the hot cell facility since August 1996. They determined that procedural adequacy, procedural compliance, and the need for increased training and awareness of europium and gadolinium characteristics were common causes for these events. They believe that the number of similar occurrences indicates that facility personnel are correcting individual procedures without identifying and correcting the overall problem.

The investigation team determined that multiple barriers failed to prevent this event and that facility managers should have questioned why the work scope deviated from the work instructions. They determined that the lack of a questioning attitude resulted in approval of incorrect work instructions. They also determined it created a condition where workers were outside of the work instruction scope and relied on a radiological control technician, who was unfamiliar with both the facility and the isotope involved, for guidance.

Facility managers should ensure that corrective actions are comprehensive and prevent recurrence. Facility personnel in charge of work instruction preparation and managers who approve work instructions should review the following documents to ensure that work packages provide specific instructions for the work scope and address all potential radiological conditions.

- DOE O 4330.4B, *Maintenance Management Program,* chapter 15, "Management Involvement," identifies the degree of management involvement in oversight and approval of maintenance activities. Chapter II, section 8.3.1, "Work Control Procedure," provides guidelines on work control systems and procedures and states that work control procedures help personnel understand the necessary requirements and controls.

- DOE/EH-0256T, *Radiological Control Manual*, states: "Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity." The manual sets forth DOE guidance on the proper course of action in the area of radiological control, including work preparation; work controls; monitoring and surveys; and training and qualifications.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities*, section 3.1.1.3, provides the key elements of an effective planning program. The standard also discusses the need for thorough reviews of work packages by experienced individuals to eliminate errors.

- NFS issued DOE/EH-0420, Safety Notice 94-03, "Events Involving Undetected Spread of Contamination," in September 1994. The notice provides guidance, good practices, and corrective actions to prevent the spread of contamination. This notice also contains information on common contributing causes, including (1) failure to follow applicable radiological protection procedures; (2) failure to

adequately perform required surveys; (3) inadequate training for personnel involved in handling and use of radioactive material; (4) failure of radiation protection personnel to properly identify, analyze, and respond to the event; (5) failure to exercise appropriate precautions when handling radioactive material; (6) inadequate supervision or management oversight of activities involving handling and use of radioactive material; and (7) inadequate identification of existing contamination.

Safety Notice 94-03 can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to the ES&H Information Center, U.S. Department of Energy, EH-74, Suite 100, Century XXI, Third Floor, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: radiation, internal exposure, contamination

FUNCTIONAL AREAS: Radiological Protection, Maintenance, Work Planning

3. CORROSIVE DEGRADATION OF STEEL COLUMN

This week OEAF engineers reviewed a final report about the corrosive degradation of a steel structural column at the Savannah River Site F-Area Analytical Laboratory. A radiation control technician discovered rust on the floor on June 15, 1997, while performing routine surveys. Believing the rust was indicative of degradation of a near-by carbon steel I-beam, he reported it to the shift manager. The shift manager confirmed the degraded condition of the I-beam. The corrosion was due to improperly stored nitric acid and resulted in a loss of approximately 35 percent of one flange of the I-beam at the floor level. Improper storage of chemicals may result in corrosion of structural steel and could result in the loss of use of a facility. ORPS Report SR--WSRC-ALABF-1997-0009)

Investigators determined that the direct cause of this occurrence was exposure to nitric acid fumes over a long period of time. The column is located in a room that was used to store a 5-gallon canister of nitric acid. Investigators determined that stress on the remaining cross-section of the column was greater than allowed by the applicable code, but less than the allowable yield. Allowable yield is the stress beyond which the metal cannot return to its original shape; code allowable stresses are considerably less than the allowable yield. Investigators determined that the root cause of the occurrence was lack of controls to prohibit the development of a corrosive environment in an unventilated room that was not designed for storing nitric acid. Investigators determined that the lack of ventilation led to the corrosive environment.

Facility managers specified the following actions as a result of this occurrence.

- removing degraded steel and applying a rust preventive coating
- restricting placement of equipment on the roof to prevent placing additional loads on the column
- removing adjacent equipment, floor coverings, and concrete to facilitate inspection
- designing and implementing structural repairs

Facility managers issued a lessons learned document highlighting how a questioning attitude could have mitigated or prevented this occurrence. They performed a facility walk-down to determine if similar conditions existed in the facility. They also had the canisters moved to a ventilated area that will not allow a corrosive environment to develop.

This occurrence underscores the importance of storing chemicals properly and illustrates the

effects of improper storage. Facility managers responsible for determining how and where chemicals are stored should consult the DOE Chemical Safety Home Page. The URL for the Home Page is http://tis.eh.doe.gov:80/web/chem_safety/.

National Research Council Publication ISBN 0-309-05229-7, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, 1995, provides guidance and recommendations regarding the safe handling and storage of chemicals, primarily in laboratory settings. Information on how to order this book can be obtained from the National Academy Press, 2101 Constitution Avenue, N.W., Washington, D.C 20418. This book can also be ordered from most larger book stores.

This occurrence also highlights the importance of assessing facility condition. Requirements and guidelines for facility condition assessment can be found in the following documents.

- DOE O 430.1, *Life Cycle Asset Management,* states that DOE, in partnership with its contractors, shall plan, acquire, operate, maintain, and dispose of physical assets as valuable national resources and use a value-added, quality-driven, graded approach to life cycle asset management.

- DOE STD 1072.94, *Guidelines to Good Practices for Facility Condition Inspections at DOE Nuclear Facilities,* provides contractor maintenance organizations with information that may be used to verify the adequacy of existing maintenance programs and to modify them or develop new programs for performing periodic facility condition inspections.

KEYWORDS: acid, corrosion, storage, structural steel, ventilation

FUNCTIONAL AREAS: Materials Handling/Storage